

REMARKS

Reconsideration and allowance of this application, as amended, are respectfully requested.

Applicant appreciates the helpfulness of Examiner Rickman during the interview of February 4, 2003. Applicant proposes to amend Figure 4 as shown by the attached drawing marked in red. Upon approval, a corrected formal drawing will be filed to replace the original.

The inventions include a nonmagnetic substrate; an underlying film having a layer exhibiting super paramagnetism and formed on said nonmagnetic substrate; and a perpendicular magnetic layer formed on said underlying film.

The layer exhibiting super paramagnetism can be formed of a soft magnetic material. The layer formed of the soft magnetic material may have either a soft magnetism or super paramagnetism by controlling film formation conditions including grain size and a component ratio.

In general, the super paramagnetism is a specific property seen in a collection of ferromagnetic fine particles. This phenomenon occurs when the collection of ferromagnetic fine particles not larger than the critical size is thermally agitated at a temperature in excess of a predetermined value, and exhibits that the behavior of individual ferromagnetic fine particles like a super paramagnetism spin.

Appendix B contains an article from the Japan Institute of Metals, vol. 38, published on December 20, 1999, page 983, FIG. 1. The granular films, even though they are formed of the same Co-Al-O base but different in composition, show different magnetism characteristics including super paramagnetism (indicated by an open circle), soft magnetism (indicated by a solid circle) and nonmagnetism (indicated by a triangle). In FIG. 1, the symbol “%” is atomic %.

Appendix C contains a copy of Japanese Patent Application Publication No. 2000-87233. See Figure 4. It is possible to obtain layers different in magnetism properties such as soft magnetism or super paramagnetism by controlling a component ratio of a layer having Fe fine particles dispersed in an Ag matrix. In FIG. 4, the symbol “%” is “atomic %”.

In the present invention, a layer is formed by appropriately controlling film-formation conditions so as to exhibit super paramagnetism and then used as the underlying film.

The magnetic property of such an underlying film is soft magnetism at cryogenic temperature and paramagnetism at normal temperature. When the perpendicular recording medium having the underlying film is used, a sharp recording magnetic field is formed during a recording process; however, the spontaneous magnetization is generated but low at a reproducing process. Therefore, the underlying film is not a source of generating noise such as spike noise and free from the influence of the external floating magnetic field in a reproducing process.

According to our claimed inventions, it is possible to suppress noise by the residual magnetization and magnetic wall of the underlying layer at normal temperature, thereby enabling high-density recording with low noise.

Preferable sizes of fine particles are 40 nm or less, as shown in claims 15 and 19. This is also described in the specification, for example, page 10, lines 7 to 9. As shown in claims 13 and 17, the layer exhibiting super paramagnetism can be formed of at least one soft magnetic material selected from the group consisting of FeTaC, FeZrO, CoFe, NiFe, CoZrNb, FeTaN, and FeZrN. For example, FeTaC is described in the specification, page 14, lines 15 to 22, FeZrO, page 17, lines 12 to 16, CoFe, NiFe, CoZrNb, FeTaN and FeZrN, page 11, lines 1 and 2.

Furthermore, the layer exhibiting a super paramagnetism may have a magnetization not larger than 20 emu/cm² when a magnetic field of 796,000 Nm, that is, 10 kOe, is applied, as indicated by the curve 104 in FIG. 4 (See proposed drawing change – Appendix A).

In the magnetic recording medium disclosed by HOKKYO in H 11-1 49628, a soft magnetic layer is provided under a magnetic recording layer. HOKKYO uses FeSi Al based alloy or FeTaN based alloy as a soft magnetic material and the underlying layer having a soft magnetism is formed only by sputtering the soft magnetic material at 600°C. HOKKYO neither discloses nor suggests that the layer exhibiting super paramagnetism is employed as the underlying layer of the magnetic recording layer. In addition, no mention is made of the size of soft magnetic particles. Since the layer exhibiting soft magnetism is formed in HOKKYO, the particle size of the soft magnetic layer is conceivably large.

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As described in the foregoing, the magnetic recording medium of the present invention is completely different in structure from that disclosed by HOKKYO. Since the recording magnetic medium disclosed by HOKKYO does not use the layer exhibiting super paramagnetism, the effect of the present invention cannot be obtained.

From this, even if the magnetic recording medium taught by HOKKYO is combined with the assembly taught by ONDA, it is impossible to arrive at the present invention.

All outstanding matters having been addressed, it is respectfully submitted that the present application is in a condition for allowance and a Notice to that effect is earnestly solicited.

Respectfully submitted,
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